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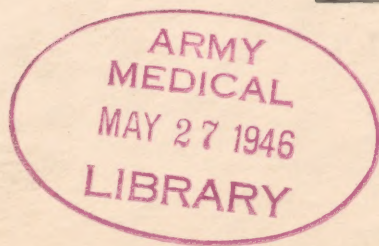
ARMORED MEDICAL RESEARCH LABORATORY

FORT KNOX, KENTUCKY

Detailed Report

On

TEST OF ADEQUACY OF K-2 RATION IN THE DESERT



INFORMATION COPY

Project No. 2-5

October 22, 1942

D E S E R T R A T I O N S T U D Y

K-2 Ration

September 20-26, 1942

DESERT TRAINING AREA

Report by:

William B. Bean,
Captain, MC.,
Assistant.

APPROVED:

Willard Machle

WILLARD MACHLE,
Lieut. Colonel, MC.,
Commanding.

REPORT ON K-2 RATION STUDY

(Submitted October 20, 1942)

To: Desert Warfare Board, Camp Young, Indio, California.

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1. INTRODUCTION, PURPOSE AND METHODS.

Special rations adapted for combat operations need certain modifications for desert warfare. These result from the environment with its high temperatures, scarcity of wood for fuel, enhanced requirements for water and salt for personnel and miscellaneous conditions peculiar to different desert regions. The present test was carried out on the K-2 Desert Ration developed by Colonel Isker of the Q.M.C. It differs from the K-1 Ration only in having the fruit juice in individual cans, packed with the ration in a single package for each meal for each soldier. Points for consideration were the acceptability, stability, packaging, satisfying qualities, and undesirable effects. Observations were made by selected medical officers on the use of the rations, their acceptance, and the general reaction to the ration during a 5-day field exercise. Comment cards were filled out by the officers and enlisted men. Special studies on water restriction, water intake without restriction, urine and chloride output were made on the personnel of a tank company and will be the subject of a report in the near future. Owing to the exigencies of field conditions some meals were missed because supply vehicles were captured. When cards were incompletely or carelessly filled out they were not included in the analysis.

2. RECOMMENDATIONS.

a. K-Ration.

(1) U. S. Field Ration K-2, modified for Desert Warfare is an excellent emergency ration for Desert Warfare operations of the Armored Forces.

(2) With certain suggested changes, U. S. Field Ration K-2 modified for Desert Warfare is recommended as a reserve and emergency ration.

b. Change the K-1 and K-2 biscuit. They were eaten by less than half of the men. Salteens, soda crackers, cheese crackers, graham crackers or sweet wafers might be tried.

c. Change the packaging. Put cigarettes and gum outside of the individual units. Napkins might be added, especially to remove the liquid grease which may spurt from the meat tins.

d. Change the cheese from the supper to the lunch unit.

e. Cocoa, a great favorite, should be substituted for the powdered soup.

f. Add a fruit bar, or some laxative when the ration is to be used for several days.

3. SUGGESTIONS.

a. Develop new meals. Monotony by the end of 5 days is marked. Corned beef and other meats might be tried.

b. Variety in brands of cigarettes, or use of unmarked packages would be of value.

c. The cans of juice would take up less room if rectangular. The tomato juice should have the ironic admonition "chill before using" removed. The use of pineapple, berry and vegetable juices might be tried.

d. Other hard candies might be used instead of the dextrose and malted milk tablets. The effect of medicated candies on thirst should be tested.

4. GENERAL REMARKS.

a. Commendations.

(1) The K-2 ration was by far the best used in the field to date.

(2) Fairness of distribution was specifically commended.

(3) Better packaging and sanitary arrangement was commented on favorably.

(4) The ready availability of the ration was particularly valuable for the changing activity of combat. Part or all of the ration could be consumed during a lull; or portions saved for some later period.

(5) Many preferred it to the "B Ration" and ate it by choice where the two were offered, after the test period.

(6) Certain line officers commented that the men had more energy and worked better toward the end of the day. This may, however, have been a result of conditioning.

b. Specific Complaints.

(1) K-1 and K-2 biscuits: "lousy", "hard", "tasteless", "flavored with chewing gum", "nauseating", "can't eat", etc.

(2) Meats: "too greasy", "tiresome", "too rich".

(3) Bouillon: "too bitter", "tastes like brine", "no good when luke warm--good when hot".

(4) Dextrose malted-milk and dextrose: "too hard", "can't eat", "chalky", "too many sweets".

(5) U. S. Army Field Ration D "too rich", "oily", "greasy", "can't eat all at once".

c. Side Effects.

(1) Constipation: It was generally noted that the ration was constipating, which was to be expected with the low residue, concentrated food with high cheese content. This complaint became more pronounced during the 3rd, 4th and 5th days.

(2) Nausea and vomiting: Four instances of vomiting were attributed to the ration during the entire test. Other factors, however, could not be ruled out.

(3) Increased water requirement: When no restriction was placed on the water intake it averaged 1.2 quarts per day more than on the 5-in-1 ration.

4. APPENDIX.

a. Test Subjects: The following personnel of the 3rd Armored Division were used:

	<u>Men</u>
Company A, 32nd Armored Regiment	112
Battery A, 54th Field Artillery	141
Company A, 23rd Engineers	190
Company C, 36th Armored Infantry	181

b. Test Conditions: The study was made during the course of war games in the Needles-Freda-Blythe area of the Colorado Desert. The problem included attack, retreat, rearguard activity and one night's blackout driving for 75 miles. The peak of summer heat had passed so the conditions were not as extreme as those in July and August. The men were subjected to routine combat conditions for desert warfare. Except where the supply system broke down when vehicles were captured, no other ration was available. The troops had been in the desert for two months, and had engaged in a number of tactical problems.

c. Participating Personnel.

(1) Members of the Desert Warfare Board under the direction of Colonel Donald B. Sanger placed the facilities of the board at the disposal of the officers in charge. Major L. W. Merriam assumed responsibility for having the mimeographed forms drawn up and distributed. Lt. Colonel Iterman, M.C. Surgeon, Camp Young, was helpful in providing medical officers to supervise the test, as was Lt. Colonel Perry, C.O., 64th Medical Battalion.

(2) In the 3rd Armored Division excellent cooperation was given by all the staff officers and line officers responsible for the several companies subject to the test.

(3) The tests were made under the direction of Capt. William B. Bean, M.C., of the Armored Force Medical Research Laboratory, Fort Knox, Kentucky, with the assistance of Major R. K. Brown, M.C.; Capt. L. B. Brindamour, M.C.; Capt. E. B. Cook, M.C.; Capt. D. N. Stephanoff, M.C.; 1st Lt. C. L. Miller, M.C.; 1st Lt. A. G. Zoet, M.C.; and 1st Lt. A. G. Ware, S.C. These officers subsisted on the K-2 ration.

d. Contents of K-2 Ration.

(1) K-2 Ration: U. S. Army Field Ration, Modified for Desert Warfare.

BREAKFAST

Orange Juice, Unsweetened, 6 oz.

K-1 Biscuit, $2\frac{1}{4}$ oz.

K-2 Biscuit, $1\frac{1}{2}$ oz.

Veal Pork Loaf, $3\frac{1}{2}$ oz.

Instant Coffee

Sugar Lumps (3)

Malted Milk - Dextrose & Dextrose Tablets, 1.6 oz.

5 Cigarettes

2 sticks Chewing Gum

LUNCH

Tomato Juice, $5\text{-}3\frac{3}{4}$ oz.

K-1 Biscuit, $2\frac{1}{4}$ oz.

K-2 Biscuit, $1\frac{1}{2}$ oz.

Pork Loaf, $3\frac{1}{2}$ oz.

Bouillon powder, 10 grams

U. S. Army Field Ration "D", 2 bars, 1 oz. each

5 Cigarettes

2 sticks Chewing Gum

SUPPER

Grapefruit Juice, Unsweetened, 6 oz.

K-1 Biscuit, $2\frac{1}{4}$ oz.

K-2 Biscuit, $1\frac{1}{2}$ oz.

Pasteurized Cheese, 4 oz.

Soluble Cocoa, 2 oz.

Fruit flavored Hard Candies, $1\text{-}3\frac{3}{8}$ oz.

5 Cigarettes

2 sticks Chewing Gum

e. Acceptability of K-2 Ration.

(1) The K-2 ration was accepted very well by the officers and men using it. It was rejected at first by only 3 men, and later they took it well. It was the general opinion that the ration as used was the best one tried to date.

(2) The K-1 biscuit met with disfavor. It was eaten regularly by not more than one-third of the test subjects. Some men grew accustomed to it towards the end of the 5-day period, but a larger number tired of it and discarded it regularly. The K-2 biscuit was received only a little more favorably. Perhaps the flavor of chewing gum and wax had something to do with it. Other items poorly received were the malted milk-dextrose and dextrose tablets and the bouillon.

(3) The quantity of the ration was adequate though many of the men desired more bulk. There was no impairment of activity attributable to the ration.

(4) Scoring of the cards was undertaken in detail but only some of the data are significant. During the 5-day period slight changes in individual tastes occurred, but they merely represented accentuation of the pattern apparent in a single days record so are not appended here. Though spaces were provided for comment on quantity they so nearly paralleled the column for quality that no additional information was obtained. In general, if the item was well liked, more was requested and vice versa.

f. Food Requirements.

(1) The caloric requirement was adequately satisfied by the ration. In a group of 40 soldiers in the tanks, the average loss of weight was less than 2 pounds.

(2) Vitamin requirements for conditions of heavy activity in the desert are not known. It is unlikely that the vitamin content of an emergency ration is as important as palatability, caloric content and stability. This is not true for a ration used for long periods of time. No evidence of vitamin deficiency was noted in any soldiers seen in the desert area.

g. Salt and Water Requirement.

(1) Additional salt was not provided with the ration which contains about 17 grams. No evidence of salt depletion was observed. Salt tablets are unsatisfactory, as used by the soldiers in the camps, because of the frequent nausea and vomiting they produce.

(2) Water needs were studied in the tank crews. It was found that with the K-2 Ration restriction of water for drinking to the level of 2 quarts a day was intolerable, that the routine duties could not be carried out and that dehydration exhaustion occurred sometime during the first day. At a level of 4 quarts daily for drinking purposes most of the men tested

were able to get along. They were not comfortable but their efficiency was not greatly reduced. They did lose weight, (an average 1.7 pounds in 4 days) and it is not probable that they could have continued indefinitely on this regime. When water was provided in unlimited quantities the men drank between five or six quarts. This was undoubtedly more than the minimum needs. The urinary output was high, approximately that of an average person in a temperate climate. The average weight loss in this group was 0.4 pounds. The morale of this group was excellent. Fluid intake with the K-2 ration was 1.2 quarts higher than in a previous test on the "5-in-1" ration.

(3) Hard candies and gum were very popular, but did not have any apparent effect on water consumption. The effect on thirst varied. There were instances of temporary subjective relief.

h. Stability and Packaging.

Packaging must be done so that the high temperatures and aridity of the desert do not damage the ration; and with a view to protecting the individual elements of the unit from spoilage, bursting of containers, intermingling of flavors and deterioration of food values. Several individual meal units burst when exposed to the sun for seven days in camp. The separate food items were not damaged, though scattered. This did not happen on maneuvers where the kitchen wagon brought up the ration once a day. Several cans of meat were found to be spoiled and a few cans rusty inside. During the heat of the day the meat containers grew warm enough to liquefy the grease which spurted out when opened. This is another reason for serving the cheese at the noon meal; and makes desirable the addition of some paper napkin or tissue to get grease off the hands where it might interfere with combat efficiency. The wax from the package melted and was disagreeable when it hardened on the coveralls though this was infrequent. Perhaps the most obvious fault was the general confusion of flavors which accumulated in the K-1 and K-2 biscuits, and added to the basic flavor made them generally unacceptable. Removal of the chewing gum to the outside would be of great help.

i. Local Environmental Conditions.

(1) During late September the heat in the desert had become moderate so that the physical strain on men and machines was not nearly so great as it had been during the period of maximum summer heat. Furthermore the men had had two months of desert training and were in excellent physical condition, well adjusted to the rigors of the climate. The figures for temperature are similar to those which obtain in the Libyan Desert.

(2) Observations on temperature made on maneuvers are appended below.

TEMPERATURE °F.

<u>Date</u>	<u>Hours</u>	<u>Dry Bulb</u>	<u>Wet Bulb</u>	<u>Relative Humidity</u>
Sept. 21	0900	89	64	23%
	1500	98	66	14%
22	0900	79	54	16%
	1500	102	65	8%
23	0900	91	66	24%
	1500	108	72	7%
24	0900	89	65	25%
	1500	104	70	13%

Minimum night temperature observed 67°F
Maximum " " " 73°F

EXHIBITS

EASTERN UNION

No. I-16052

VEP200 TWS PAID 3 GOVR WUX FTHAYES OHIO 9 90 8P

C G FTKNOX KY

186 WDS. THEODORE F MITCH NAUGHT FOUR EIGHT NAUGHT SIX SIX THREE
 SN C COMA CAPT LISTER B ROBERTS NAUGHT FOUR EIGHT NAUGHT FIVE SEVEN
 ONE SN C COMA CAPT WILLIAM B BEAN NAUGHT FOUR EIGHT FIVE SIX SIX
 NAUGHT MC COMA FIRST LT NORTON A NELSON NAUGHT FOUR EIGHT NAUGHT
 SIX TWO TWO SN C AND MR SGT THEODORE C SWIGERT THREE TWO NAUGHT THREE
 NAUGHT FOUR SIX FIVE MD ARMED FORCE MEDICAL RESEARCH LABORATORY FOUR
 STAFF WITH SUCH TECHNICAL EQUIPMENT AS MAY BE NECESSARY TO CYOUNG
 CALL IN OR ABOUT IN AUG FORTY TWO ON TEMP DUTY FOR PURPOSE CARRYING
 OUT INSTRUCTIONS OF THE CG AFG AND UPON COMPLETION OF THIS TEMP DUTY
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 THEM GNACS

MCNAIR AGF WASHN DC

ACTION CY TO: AG

 Copies furnished AF Surg,
 Medical Res. Lab. and G-4

HEADQUARTERS ARMORED FORCE
Fort Knox, Kentucky

August 10, 1942

Special Orders)
 :
Number 222)

1. Pursuant to instructions contained in telegram, CG, AGF, Aug 9, 1942, the following named officers and EM, AF Med Research Lab, SF with such technical equipment as may be necessary, on or about Aug 10, 1942, fr Ft Knox, Ky, to Camp Young, Indio, Calif, on temp duty for the purpose of carrying out instructions of the CG, AGF.

Maj Theodore F. Hatch, 0480663, Sn C,
Capt William B. Bean, 0485660, MC,
Capt Lester B. Roberts, 0480571, Sn C,
1st Lt Norton A. Nelson, 0480662, Sn C.

M Sgt Theodore C. Sweigert, 32030465.

Upon completion of this temp duty they will return to their proper sta, Ft Knox, Ky. It being impracticable for the Govt to furn rtns in kind, meals for one (1) man will be furn under the provisions of AR 30-2215 for such meals as the length of the journey may require at a rate not to exceed \$0.75 per meal, or not to exceed \$1.00 per meal per man when meals are taken in the dining car. Unused meal tickets will be turned in to proper auth at conclusion of journey for return to issuing QM. TDN. FD er P 434-02, -03 A 0425-23; TS 505 F 481-03 A 0502-23; TS 508 F 481-03 A 0502-23. (AG 210.453 - 220.453)

FORM OF QUESTIONNAIRE
One was supplied for each day

RATION K-2 - EMERGENCY

Report to be filled in after consumption of each meal
by the individual soldier. (✓) in appropriate space.

BREAKFAST UNIT

ITEMS	QUALITY			QUANTITY			REMARKS
	Good	Fair	Poor	Too Much	Suff.	Not Enough	
1. 1 Can, Fruit Juice, 6 oz.	()	()	()	()	()	()	
2. 1 Can, Veal-Pork Loaf	()	()	()	()	()	()	
3. 1 Pkg. K-1 Biscuit	()	()	()	()	()	()	
4. 1 Pkg. K-2 Biscuit	()	()	()	()	()	()	
5. 1 Pkg. Malted Milk Dextrose Tablet	()	()	()	()	()	()	
6. 1 Pkg. Granulated Sugar	()	()	()	()	()	()	
7. 1 Stick Chewing Gum	()	()	()	()	()	()	
8. 1 Pkg. Soluble Coffee	()	()	()	()	()	()	
9. 1 Pkg. Cigarettes (5)	()	()	()	()	()	()	

DINNER UNIT

1. 1 Can Tomato Juice	()	()	()	()	()	()	
2. 1 Can Pork, Luncheon Loaf	()	()	()	()	()	()	
3. 1 Pkg. K-1 Biscuit	()	()	()	()	()	()	
4. 1 Pkg. K-2 Biscuit	()	()	()	()	()	()	
5. 2 Pkg. U. S. Field Ration D	()	()	()	()	()	()	
6. 1 Pkg. Dry Bouillon	()	()	()	()	()	()	
7. 1 Pkg. Cigarettes (5)	()	()	()	()	()	()	

SUPPER UNIT

1. 1 Can Grapefruit Juice	()	()	()	()	()	()	
2. 1 Pkg. Pasteurized Process Cheese	()	()	()	()	()	()	
3. 1 Pkg. K-1 Biscuit	()	()	()	()	()	()	
4. 1 Pkg. K-2 Biscuit	()	()	()	()	()	()	
5. 3 Fruit Bars	()	()	()	()	()	()	
6. 1 Stick Chewing Gum	()	()	()	()	()	()	
7. 1 Pkg. Instant Cocoa	()	()	()	()	()	()	
8. 1 Pkg. Cigarettes (5)	()	()	()	()	()	()	

SUMMARY OF COMMENT CARDS

BREAKFAST UNIT

	<u>Percentages</u>		
	<u>Good</u>	<u>Fair</u>	<u>Poor</u>
Orange Juice (6 oz.)	80	17	3
Veal-Pork Loaf	74	22	4
K-1 biscuit	7	30	63
K-2 biscuit	12	38	50
Malted Milk - Dextrose	46	36	18
3 Lumps of Sugar	83	16	1
2 Sticks of Gum	92	7	1
Soluble Coffee	78	18	4
Cigarettes (5) Old Gold	84	12	4

LUNCH UNIT

Tomato Juice	86	11	3
Pork Loaf	75	21	4
K-1 biscuit	7	30	63
K-2 biscuit	13	37	50
2 Field Ration "D" (chocolate)	67	26	7
Bouillon	47	31	22
Cigarettes	82	12	6

SUPPER UNIT

Grapefruit Juice	72	20	8
Cheese	77	17	6
K-1 biscuit	6	33	59
K-2 biscuit	11	40	49
Candy (Charms)	81	16	3
Chewing Gum	91	7	2
Instant Cocoa	87	11	2
Cigarettes	80	13	7

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		Percentages		
		Good	Fair	Poor
<u>JUICES</u>				
BREAKFAST:	Orange Juice	80	17	3
LUNCH:	Tomato Juice	86	11	3
SUPPER:	Grapefruit Juice	72	20	8

<u>MEATS</u>				
BREAKFAST:	Veal Pork	74	22	4
LUNCH:	Pork	75	21	4
SUPPER:	Cheese	77	17	6

<u>BISCUIT</u>				
BREAKFAST:	)	7	30	63
LUNCH:	) K-1	7	30	63
SUPPER:	)	8	33	59
BREAKFAST:	)	12	38	50
LUNCH:	) K-2	13	37	50
SUPPER:	)	11	40	49

<u>SWEETS</u>				
BREAKFAST:	Malted Milk - Dextrose	46	36	18
LUNCH:	Field Ration "D" (Chocolate)	67	26	7
SUPPER:	Hard Candy (Charms)	81	16	3

<u>CONCENTRATES & DRINKS</u>				
BREAKFAST:	Coffee	78	18	4
LUNCH:	Bouillon	47	31	22
SUPPER:	Cocoa	87	11	2

<u>CIGARETTES</u>				
BREAKFAST:	)	84	12	4
LUNCH:	) Old Gold	82	12	6
SUPPER:	)	80	13	7

<u>MISCELLANEOUS</u>				
SUGAR LUMPS		83	16	1
CHEWING GUM		92	7	1
CHEWING GUM		91	7	2

